to another that special degrees of activity are to be observed. Such, for example, are the electrical phenomena seen in the oxidation of phosphorus or benzaldehyde, and it appears that, in the photo-chemical system of the green plant, radiant energy is caught on the way, as it were, to its degradation to heat, and utilized for chemical work. In a somewhat similar way, it might be said that money in the process of transfer is more readily diverted, although perhaps not always to such good purpose as in the chloroplast. Again, just as in commerce money that is unemployed is of no value, so it is in physiology. Life is incessant change or transfer of energy, and a system in statical equilibrium is dead.

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THE PUBLICATION OF THE RESULTS OF INVESTIGATIONS MADE IN EXPERIMENT STATIONS IN TECHNICAL SCIENTIFIC JOURNALS[1]

In order to gain a proper perspective for a consideration of the topic which has been assigned the final place in this discussion of experiment station publications, namely, the publication of results in scientific journals, including the *Journal of Agricultural Research,* it will be necessary to consider very briefly certain historical aspects of the question. Until within the last few years it has been a well-nigh universal practise of the experiment stations in this country to publish all, or very nearly all, of the material which they have had for publication in the form of bulletins. The reason for this practise, which has always seemed anomalous to scientific workers in other than agricultural fields, is of course found in the historical beginnings of station work and station publication in America.

Section 1 of the Hatch Act provides "That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation of agricultural science," experiment stations were to be established. Further on Section 4 provided "That bulletins or reports of progress shall be published" as often as once in three months, and these distributed to farmers and newspapers.

Now the idea plainly embodied in all this was that the station should issue bulletins in order that the farmers might be informed of the nature and results of its activities. This entirely laudable idea worked well enough at first. Very presently, however, as the character and quality of the station work changed and the stations began in some measure to fulfil the second purpose for which they were organized, namely, to contribute to agricultural knowledge by investigation, it came about that bulletins were sometimes issued which, from the very nature of the case, left the farmer, who had the temerity to tackle reading them, on the whole rather worse informed when he had finished than he was before he began. Something of this sort was bound to be the case as soon as experiment station work was of anything but the most superficial character. Just as soon as there began to be issued in bulletin form really scientific papers, of a technical character, it became evident that the publishing activity of a station must perform two separate and distinct functions, and not merely a single one as was evidently contemplated by those who prepared the Hatch Act.

These two functions are: (1) To inform the general public of the activity of the station, with reference to such matters as it (the public) is actually interested in from the viewpoint of practical farming. In other words, one function of station publication is, in the language of the original act, to diffuse among the people useful and practical information. (2) The second function of station publication is

[1] From the Maine Agricultural Experiment Station. This paper formed a part of a symposium on the various forms of station publication at the California meeting of the Association of American Agricultural Colleges and Experiment Stations in the Station Section. The paper was read by Director Charles D. Woods, in the absence of the author.

to promote the progress of agricultural science and stimulate further investigation by making available to workers in that branch of science complete and detailed technical accounts of what has already been done. Technical scientific publication is absolutely necessary to the advance of science. The reason why scientific men publish their results is *not,* as some executives sometimes appear to believe, in order that they may get better jobs, but to contribute their mite to the accumulated and classified experience of the world, which is science.

The distinction between these two reasons for publication was almost entirely lost sight of in the earlier history of the stations. One regrets to observe that even in the present enlightened era of experiment station evolution there does not appear to be universally present a clear and complete discrimination between these two different, and indeed essentially antithetic, sorts of publication. Not very long ago one of our most distinguished directors, in a praiseworthy desire to assert the equality (or even superiority) in respect of intellectual attainment of his constituency as compared with the constituencies of other stations, made a statement in a scientific journal to the broad effect that his institution never had and probably never would put out anything not easily within the comprehension of the worthy and enlightened farmers of his state. Leaving aside as not quite relevant here the fact that such a statement carries *two* implications, one of which I fancy its genial author overlooked in his zeal to make the other, it would seem clear that such a position does not do full justice to the purely scientific function of a part of any station's publications.

The general thesis which I should like to make the text of this paper is that while what has been called above the first function of station publishing activity, namely, the diffusing among the people of useful knowledge, is, on the whole, well served by the bulletin form; on the other hand, the second or purely scientific function of station publishing is, on the whole, badly served by that form. Further, the attempt will be made to show that the best manner of serving the second function, which the whole experience of the world's scientific workers has brought forth, is by publication in established scientific journals.

As a first step towards the establishment of this thesis it is desired to quote a short extract from a most entertaining and famous treatise published nearly four hundred years ago. This work is "A Boke, or Counseill against the Disease Commonly Called the Sweate, or Sweatyng Sicknesse made by Jhon Caius, Doctour in Phisicke. Uery necessary for euerye personne, and muche requisite to be had in the handes of al sortes, for their better instruction, preparacion and defence, against the soubdein comyng, and fearful assaultyng of the same disease. 1552."

John Cajus, or, in its English form Kaye, it will be recalled, was the man who brought about the elevation to the rank of a college of Gonville Hall at Cambridge, since known as Gonville and Cajus College. He was one of the most distinguished physicians of his day, and withal an exceedingly keen, witty and shrewd person, whose great learning never upset his common-sense. In his introduction to the "Sweatyng Sicknesse" he mentions his earliest writings, which were translations out of Latin into English. He goes on to say:

> Sense y^{t} tyme diuerse other thynges I haue written, but with entente neuer more to write in the Englishe tongue, partly because the comoditie of that which is so written, passeth not the compasse of Englande, but remaineth enclosed within the seas, and partly because I thought that labours so taken should be halfe loste among them whiche sette not by learnyng. Thirdly for that I thought it beste to auoide the judgment of the multitude, from whome in maters of learnyng a man shalbe forced to dissente, in disprouyng that whiche they most approue, & approuyng that whiche they moste disalowe. Fourthly for that the common settyng furthe and printig of euery foolishe thyng in englishe, both of physicke vnperfectly, and other matters vndiscretly diminishe the grace of thynges learned set furthe in thesame. But chiefly, because I wolde geue none example or comforte to my countrie men (who I wolde to be now, as here tofore they haue bene, comparable in learnyng to men of other countries), to stande onely in the Englishe tongue, but to leaue the simplicite of thesame, and to procede further in many and diuerse knowledges

bothe in tongues and sciences at home and in vniuersities, to the adournyng of the common welthe, better seruice of their kyng, & great pleasure and commodite of their own selues, to what kinde of life so euer they shold applie them. Therfore whatsoeuer sence that tyme I minded to write, I wrate y^e^ same either in greke or latine.

In this quaint phraseology of three centuries and more ago are stated the fundamental reasons why experiment station workers of to-day will do well to publish the major portion of the purely scientific results of their labors not in bulletins, but in established scientific journals. Point for point, the reasons why learned men should publish their best technical results in the best technical manner were precisely the same in the sixteenth century as they are now in the twentieth. Let us see: The "comoditie" of the station bulletin very rarely indeed passes the compass of America, and consequently fails to get the attention of the European workers in the same field. Secondly, the labors taken in the carrying out of a piece of investigation are indeed more than "halfe loste" if the results are published in a bulletin which chiefly comes to the attention of the farmer, who certainly "settes not by learnyng," in the sense that he is in no wise interested in the technicalities of science.

The third point is one about which we can not perhaps expect full agreement, but as honest differences of opinion can do no harm, let me state clearly as my own conviction, that our friend Kaye is right in his assertion that good work is harmed, and the cause for which it stands is harmed, by so publishing it as to invite the unintelligent criticism of uninformed people. This is exactly what we do whenever we publish technical scientific material in bulletins distributed to the general farming public. In spite of the somewhat rabid admonishings which were directed towards the writer when he made the same statement once before, he ventures now to reiterate that the general agricultural public is, as a class, totally incapable of forming any just opinion of the meaning or value of the technical details of scientific work. To invite them to form and express such opinion merely calls down upon the station and the author ridicule or worse. For those, if there be any such still, whose democracy is so intense as to lead them to the conviction that there are no differences between men, and that the humblest hired man on the farm is the intellectual peer of a Newton or a Darwin, the above will sound undemocratic. It really is not. To preserve peace in the family[2] I am willing to admit that *perhaps* we might all be Newtons had we been subjected to the same environment. My only point is that, whether because of heredity or environment, *in real fact* we are not all Newtons. A page of Sanskrit is, I very much regret to say, totally incomprehensible to me. There are many pages of many bulletins which have been issued by American experiment stations which are totally incomprehensible to most farmers. May we not, then, without calling each other names like "codfish aristocrat," let the matter rest here, and turn to Cajus's fourth point? That point, taken over into our present "universe of discourse," is that since a great deal about agriculture that is purely practical, not scientific in any sense, and of an entirely ephemeral nature, has been and is continually published in bulletin form, it can only work to the hurt of first-class research work, such as nearly every one of our stations is producing, to publish it in bibliographical community with the trivial matter which composes so great a part of bulletin literature as a class. Literary and scientific productions, as well as men, are judged by the company they keep.

The fifth and the "chiefe" reason why the stations should publish more of their research work in journals rather than bulletins is because of the educational value of that method for the station men themselves. If a piece of work is submitted to a technical journal for publication, that work must pass a test of merit which is entirely independent of station politics, executive favoritism, the marital connections of the author, the probable effect on the constituency and next year's appropriation, and a host of other things which have been known to play a part in bulletin publication. The work will be judged by the editorial board

[2] But *only* for that reason!

of the journal strictly on its own merits as a piece of scientific research, and on no other basis. Journal publication provides each director with an opportunity to see the scientific work of his station as others see it. Scientific papers are not unlike favorite sons: it is often very difficult for the fond parent to discern in them any faults at all. Independent editorial boards, on the other hand, do that sort of thing very well.

If an independent chemical, or botanical, or zoological, or bacteriological, or agricultural journal refuses to publish a paper submitted from a station, the author and the director are bound to come to the conclusion, since no other is possible, that in some way or other this paper does not measure up to a standard which disinterested experts in the given field of knowledge regard as the irreducible minimum below which sound scientific work can not fall. On the other hand, if it is accepted the work receives the hallmark of standard character.

There is one objection which has been raised to the publishing of a part or the whole of a station's scientific output in different journals which should receive careful attention. This objection is that by this practise the station's work as a whole does not make the impression of large unity which it does if it is all published in one place, namely, the bulletins of the station itself. A somewhat vulgar expression of this same idea which one sometimes hears is that journal publication makes for the aggrandizement of the author at the expense of the station. It has been a theory of station management in some quarters, though now the theory is conspicuous by its nearly complete absence, that the station as such should alone have visible existence and that the individuals composing the staff (save possibly the director) should be publicly considered as invisible, undiscoverable nonentities, not at home. Journal publication has been considered subversive of this pleasant arrangement.

This theory seems to overlook certain facts of psychology, common sense and ethics. It appears entirely clear that the nearer the actual conditions in a station approach to the theory that the members of its staff are individual nonentities, the smaller is bound to be its measure of glory with its constituency and its peers, quite regardless of its mode of publication. For, after all, a station *is* its staff, *et præterea nihil.*

As a matter of fact, the mere existence of an official institution always suffices to gather to the institution a large part of the *kudos* which may attach to the accomplishments of its component individuals. Plenty of evidence of this, if evidence be needed, is seen in the very small influence an individual can exert except as a member of an organization or institution. And conversely, an institution never gains fame or influence, except through the ability and the achievements of its individual members. The New Paradise Experiment Station is a great station because it has on its staff Dr. J. Doe and Professor R. Roe, who are investigators of great originality and ability, and because its director is a wise and far-sighted man.

To come back to the first point, it is very much to be doubted whether the scattering of the technical publications in journals in any degree detracts from the fame or influence of the station. On the contrary, it is probable that both of these things are considerably increased by this mode of publication. The journals are the standard channel for bringing new results to the attention of the scientific world. They unquestionably reach a much wider audience of scientific men than do the bulletins even under the most favorable circumstances.

So far we have spoken of scientific journals in general. Now let us turn to one in particular, which should interest every station worker in this country, the *Journal of Agricultural Research.* This journal became, almost exactly one year ago, the official organ of this Association and the United States Department of Agriculture jointly. Experiment station papers are received and published on precisely equal terms with department papers. One half of the members of the editorial board are station men. In the editing of the journal the attempt is being made to set a standard as to scientific content and literary form for the papers which shall be as high as the

highest maintained by independent scientific journals, whether in the field of pure or applied science. The journal is being given an extremely comprehensive standard library circulation throughout the world. For the first time it provides a medium of publication, altogether worthy of the best American work in agricultural science.

Will the stations support the *Journal of Agricultural Research* by sending to it specimens of their best output? The past year's experience indicates that the *Journal* meets a real need and will be supported by the stations. Papers have been published or accepted for publication from the following stations: California, Montana, Utah, Minnesota, Illinois, Wisconsin, Michigan, Ohio, Tennessee, Kentucky, both New York stations, Pennsylvania (Institute for Animal Nutrition), New Jersey, North Carolina, Florida and Maine. Which is not a bad showing for the first year!

Altogether it seems to the writer to be inevitable, as the experiment stations take on more and more the character of research institutions, and leave behind more and more that type of activity which was essential at the beginning, but is now being taken over by extension departments, that there will be all the time an increasing proportion of the scientific output published in the standard established scientific journals. In this way only can it take the place which is its due in the world's scientific literature.

Raymond Pearl

THE NAVAL CONSULTATION BOARD

The board appointed by national scientific and engineering societies at the request of the secretary of the navy met in Washington on October 7. Officers were elected as follows:

Chairman, Thomas A. Edison, Orange, N. J.

First Vice-chairman, Peter Cooper Hewitt, New York.

Second Vice-chairman, William L. Saunders, Plainfield, N. J.

Secretary, Thomas Robins, Stamford, Conn.

Assistant to Chairman, M. R. Hutchinson, Orange, N. J.

The board approved a plan for the establishment of a research and experimental laboratory for the United States navy, regarding which a statement was made public as follows:

1. The laboratory should be located on tidewater of sufficient depth to permit a dreadnought to come to the dock. (*B*) It should be near but not in a large city, so that supplies may be easily obtained and where labor is obtainable.

2. The laboratory should be of complete equipment, to enable working models to be made and tested to destruction. There should be: (*A*) A pattern shop; (*B*) a brass foundry; (*C*) a cast iron and cast steel foundry; (*D*) machine shops for large and small work; (*E*) sheet metal shop; (*F*) forge shop for small and large work; (*G*) marine railway large enough to build experimental submarines of 1,500 tons; (*H*) woodworking shops; (*I*) chemical laboratory; (*J*) physical laboratory; (*K*) optical grinding department, etc.; (*L*) motion picture developing and printing department; (*M*) complete drafting rooms; (*N*) electrical laboratory and wireless laboratory; (*O*) mechanical laboratory and testing machines; (*P*) explosives laboratory, removed from main laboratory.

3. The building should be of modern concrete construction, with metal sills and doors, wire glass windows, etc. Ample fire protection.

4. A naval officer of rank should be in charge. He should be especially fitted. (*B*) Under him should be naval heads of broad experience in laboratory methods and science in general—practical as well as theoretical men. They should not go to sea. (*C*) Under them should be staffs of civilian experimenters, chemists, physicists, etc. (*D*) Each sub-head should have his corps of assistants, and with shop facilities, without too much red tape. (*E*) There should be at least two, and possibly three, shifts of men. Time should be the essence of the place.

5. Secrecy should be the governing factor. The place should be surrounded by a high fence and guard maintained at all hours. No visitors allowed.

6. Facilities should exist for enabling the inventor to assist in the development of the idea he has presented, provided he is a practical man.

7. The investment for grounds, buildings and equipment should total approximately $5,000,000.

8. The annual operating expenses to be between $2,500,000 and $3,000,000.